

3GPP TSG RAN Rel-19 workshop
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Agenda:5
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Network Energy Saving for Rel-19

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- In Rel-18 network energy saving(NES) SI, following work has been done:
 - » **Define the relative base station energy consumption model**
 - » **Define the KPI and evaluation methodology for NES**
 - » **Multiple techniques were studied and evaluated based on the defined methodology**
 - Potential NES techniques in time/spatial/power/frequency domain
 - ✓ Evaluation results (performance loss and energy saving gain) of ~20 techniques were drafted in TR 38.864
- In Rel-18 NES WI, only part of the studied techniques were included:
 - » **Spatial & power domain**: the adaptation of spatial elements and transmission power based on the CSI procedures (RAN1 lead)
 - » **Time domain**: introducing the cell DTX/DRX mechanism (RAN2 lead)
 - » **Frequency domain**: SSB-less of SCell for intra-band CA for FR1 (RAN4 lead)

- Energy consumption has been a heavy burden for operators in 5G
 - » The electricity cost of a 5G base station is more than 3 times of that of LTE, and the energy consumption has been accounted for the largest part of network operating costs (~49%) currently.
- Energy issue will be more severe in the future
 - » 6G network may operate with higher frequency, wider bandwidth and larger scale of antennas, leading to much higher-level power consumption but smaller coverage, which will result in higher energy consumption for network as well as higher OPEX/CAPEX.
- Green communication is a world-wide concerned issue
 - » Network energy saving is of vital importance for achieving the carbon peak and carbon neutrality for communication, which is nowadays a global issue.

■ Background

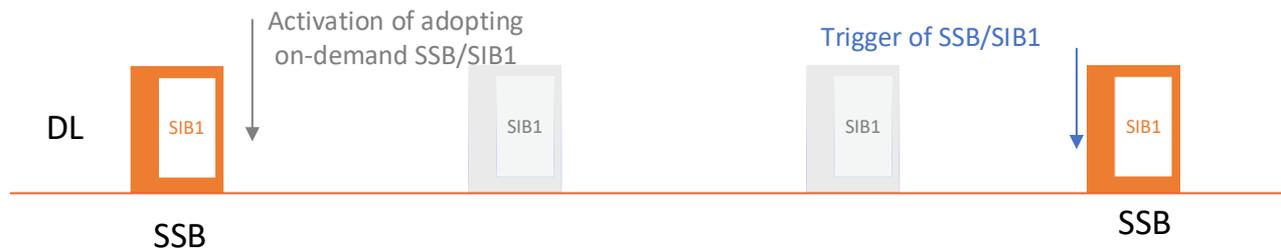
- » Evaluation model and methodology in Rel-18 NES SI provides the fundamental for further work.
- » Many techniques were evaluated with large NES gain in Rel-18 SI but not included in the WI, which can be start points for NES in Rel-19.
 - The techniques that have impact on SSB are precluded in Rel-18 WI, which can be considered in Rel-19.

■ Potential schemes

- Specify the procedures for reducing the transmission of common channels/signals
 - ✓ Specify the on-demand SSB/SIB1 mechanism requested by UE/neighbor cell.
 - ✓ Specify the adaptation of common channels/signals.
- Specify the adaptation of TRPs in multi-TRP scenario.
 - ✓ Specify the mechanism that UE triggers the TRP dynamically transmitting and receiving channels/signals for multi-TRP.

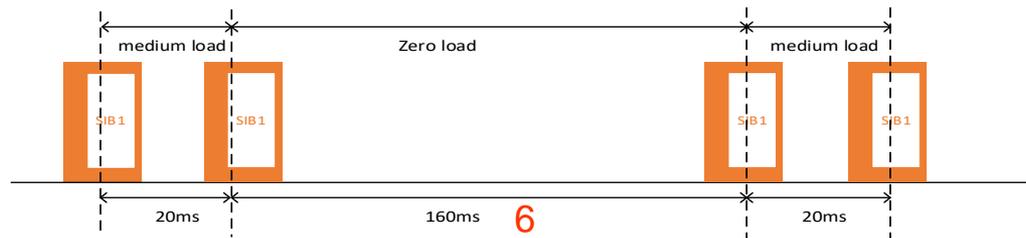
■ On-demand SSB/SIB1 mechanism

- » The SSB/SIB1 are always transmitted periodically to guarantee the RACH performance of UE in the current specs. What's more, the number of SSB/SIB1 may be larger due to the higher frequency and lower latency requirement in the future, which will lead to higher energy consumption. Therefore, introducing on-demand SSB/SIB1 for low load network can be beneficial for NES, which can bring a 22%-43% energy saving gain according to TR 38.864.
- » Thus, we propose to specify on-demand SSB/SIB1:
 - Specify on-demand SSB/SIB1 mechanism, e.g., activation/de-activation mechanism, periodicity configuration.
 - Specify the trigger signals/mechanism for on-demand SSB/SIB1 transmission.
 - Study the feasibility to introduce the longer periodicity of SSB/SIB1 for on-demand SSB/SIB1.



■ Adaptation of common channel/signals

- » Besides SSB/SIB1, other downlink common and broadcast signals (e.g., paging, cell common PDCCH) are also transmitted periodically. For the network with zero/low/medium load, adapting these common signals/channels in time domain, large energy saving gain can be achieved with little impact on performance. According to the TR 38.864,
 - By skipping SSB/SIB1, up to 25.4% energy saving gain can be achieved;
 - By adapting SSB/SIB1 periodicity, up to 84.8% energy saving gain can be achieved, and at least 15% gain can be achieved in most cases.
 - By adapting Paging/SSB patterns, up to 42.3% energy saving gain can be achieved.
- » Thus, we propose to specify the adaptation of common channel/signals.
 - Identify the common channels/signals that can be adapted transmission based on the network load, e.g., SSB/SIB1.
 - Specify the adaptation schemes of common channel/signals, at least the adaptation of periodicity.



- The adaptation of TRPs in multi-TRP scenario
 - » Multi-TRP transmission has been introduced since Rel-16, and more standardization work has been done in Rel-17/18. The corresponding architecture will be more common in the future, e.g., multiple DUs connected with a single CU. Support UE to trigger the on/off the TRPs and realizing dynamically transmitting and receiving channels/signals of the TRPs for multi-TRP scenario, which can bring 30%-40% energy saving gain.
 - » Thus, we propose to specify the adaptation of TRPs in multi-TRP scenarios
 - Specify the mechanism of Multi-TRP adaptation triggered by UE.
 - Specify the interaction between TRPs and TRP/UE to achieve multi-TRP adaptation.

Thanks!
